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(54) IMPROVEMENTS IN OR RELATING TO SWITCHES

(71) We, BURGESS MICRO SWITCH COMPANY, a British Company of Dukes Way, Team Valley, Gateshead, County Durham, NE11 0UB, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electrical switches and is concerned more particularly with switches for use in conjunction with rotary mechanisms, such as in a vehicle automatic gear selector mechanism, to give an electrical switching function in conjunction with the movement of such a mechanism.

According to the invention, there is provided a switch assembly arranged to be operated by a rotary shaft and comprising a plurality of fixed contact elements and at least one switching member rotatable with said shaft, said member comprising contact means arranged to engage the contact elements at least one predetermined angular position of the shaft to connect said elements electrically, resilient means being arranged to provide contact pressure between the contact means of the member and the contact elements, and support means being provided for the switching member to hold the contact means in an air gap when out of engagement with the fixed contact elements, said contact elements being disposed at a level relative to said support means such that the contact means of the switching member are lifted from said support means by engagement with the fixed contact elements.

The contact means of the switching member may comprise a plurality of contacts on respective arms extending outwardly from the axis of said rotation, the or a part of the support means acting on said arms.

Conveniently, the contact elements are arranged at spaced intervals adjacent the radially outer region of the switching member and said support means may comprise an arcuate track arranged to bear on a part of the switching member that is disposed radially inwardly of the contact means.

In another preferred feature of the invention, a coil spring acts as said resilient means at an inner annular region of the switching member, an inner support being provided for the member opposite the spring at an annular region radially outside said inner region but remote from the region of the contact elements.

In the application of the invention to a vehicle automatic gear selector mechanism, at least two contact elements may be associated with a starting circuit of the vehicle engine and the rotary shaft is associated with a selector lever of the mechanism, said switching member being arranged to permit operation of the starting circuit in a plurality of positions of the seletcor lever by virtue of the member having alternative contact portions for connection of said plurality of contact elements at the different shaft positions.

Also, there may be at least two of said contact elements associated with a circuit for reversing light or lights on the vehicle, and said switching member may then be arranged to connect said elements when the rotary shaft is placed in the reverse gear selection position of the mechanism, to permit operation of the reversing light then.

The invention will be more particularly described with reference to an embodiment adapted to be incorporated in a vehicle automatic gear-change arrangement and shown in the accompanying drawings, wherein:—

Fig. 1 is a transverse sectional view of a switch assembly according to the invention,

Figs. 2 and 3 are views of the cover and body, respectively, of the assembly of Fig. 1, with their associated parts, in the directions A—A and B—B shown in Fig. 1, and

Fig. 4 illustrates schematically the arrangement of the switch assembly of Figs. 1 to 3 in conjunction with associated elements of a vehicle having an automatic transmission system.

Referring to the drawings, the assembly

[Price 33p]

comprises a moulded case body 2 and cover 4 secured together by, e.g. rivets (not shown) through holes 12, 14, 16. A collar 6 extends between aligned apertures in the body and cover and has a flat sided aperture 8 running through one end that receives a complementary-form end of an operating shaft (not shown) projecting through bore 10 from the automatic gearbox selector unit and forming part of an automatic gear selector mechanism, the casing being mounted on the unit using screws or rivets (not shown) through the hole 11, 12, 14, 16.

The collar 6 has bearing engagements on a rim 18 of the aperture in the cover 4, through which it projects, and on an annular recess 20 in the case body 2, in which end flange 22 of the collar seats. The aperture 8 forms a keying connection whereby the collar rotates with the operating shaft.

Switching members 24, 26 of the assembly have ring-like inner regions by which they are mounted on a main, generally cylindrical part 28 of the collar 6 and they are separated by an electrically insulating washer 30 bearing on said ring-like regions. A supplementary ring-like switching member 29 is also mounted on the collar part 28 and bears directly on the ring-like inner region of the switching member 24. Internal tabs or flats 31 of the three members and of the washer fit slots or complementary flats in the collar main part 28 so that the members and the washer rotate with the collar. A coil spring 32 between the flange 22 and the member 26 holds the members 24, 26, 29 and the washer 30 together and urges them towards the cover 4 on which bearing tracks are provided for the switching members.

The members 24, 26 are of an electrically conductive material and have a series of radially extending contact fingers, there being three fingers 34*a* on the member 24 and two fingers 34*b* on the member 26, each finger terminating in a contact button 36*a* or 36*b*. The fingers 34*b* are cranked so that the outer ends of both groups of fingers are co-planar. Pairs of terminals 38*a*, 38*b* are mounted in closely fitting recesses in the cover 4 at spaced angular positions relative to the axis of the collar, for co-operation with the buttons 36*a*, 36*b*. The switching member 24 is associated with the terminals 38*a* and the angular spacing between each adjacent pair of its fingers 34*a* is the same as that of the terminals 38*a*. In two different angular positions of the collar and shaft, therefore, the two terminals 38*a* are simultaneously contacted by the buttons of the two fingers and are thus electrically connected by the member 24. Similarly, it is arranged that in another angular position of the collar and shaft the terminals 38*b* are connected electrically in the same manner by the switching member 26.

The third switching member 29 has its main body formed of an electrically insulating material but over an arc of the face of the member adjacent the cover 4, an insert 40 of conductive material is adhered or moulded to the main body. Resilient contact arms 42 project from recesses 44 in the cover inner face to have contact buttons 42*a* projecting from the recess to be engageable with the arcuate insert 40. The arms 42 are secured in place by rivets 46 which pass through the cover and secure terminal tabs 48 to the external face of the cover for connection of the arms 42 to an external circuit.

By virtue of the insulating body of the member 29, the contact arms 42 are isolated from the switching members 24, 26. Also, the permitted movement of the shaft collar in relation to the terminals 38*a*, 38*b* is such that at no time can the fingers 34*b* connect the terminals 38*a* or any two of the fingers 34*a* connect the terminals 38*b*. Such a result in respect of said terminal elements can be achieved either by limiting the angular extent of movement of the collar and shaft or by providing different angular spacings between the terminal elements of each pair.

The cover 4 has an inner bearing track 50 divided into two parts by the recesses 44 and against which the assembly of switching members is urged by the spring 32. Also, a slightly higher, outer arcuate track 52 is provided on the cover, this being adjacent the inner ends of the terminals 38*a*, 38*b* and being interrupted by the recesses receiving the terminals. The fingers of the switching members 24, 26 bear on the track 52 when they are not engaged with said terminals and are thus held with their contact buttons spaced from the inner surface of the cover. As is seen in Fig. 1, the terminals 38*a*, 38*b* are recessed below the level of the track 52 but to an extent less than the thickness of the contact buttons, so that as each finger coincides with a terminal the finger is lifted from the track with a degree of flexure and the force of flexure acts to urge the button firmly against the contacting terminal. In their region of contact with the buttons the terminals have chamfered side faces, as at 54, to allow the contact buttons to ride freely over them. The pre-loading of the switching members against the cam track and the terminals simplifies the manufacture of the switching members since then the need for flatness of the members is less important and a greater tolerance is acceptable in this respect.

As indicated in Fig. 4, the switch assembly is mounted on an automatic selector mechanism 56 with its collar 6 engaged by a shaft 58 on which selector lever 60 of the mechanism is secured so that the switching members are displaced relative to their associated terminals with pivoting of the selector lever.

The lever is shown in an end location that is associated with the "park" position of the selector mechanism. In this state, the terminals 38*a* are connected by the switching member 24 so that the member provides an electrical link in starter circuit 62 of the vehicle engine thereby allowing the vehicle engine to be started.

Movement of the lever clockwise (as seen in Fig. 4) brings the selector mechanism next to the reverse drive condition. In this state, the terminals 38*a* are now no longer connected by the member 24 so that the engine cannot be started, while the terminals 38*b* are connected by the switching member 26, this making a reversing light circuit 64 so that the reversing lights of the vehicle are switched on automatically as the driver selects reverse movement. Further movement of the lever 60 disengages the member 26 from the terminals 38*b* and the lever next reaches the "neutral" position in which the member 24 again provides an electrical link between the terminals 38*a* of the starter motor circuit.

Pivoting the lever 60 beyond this position brings the selector mechanism into a plurality of drive positions and at this stage the contacts 42 of seat belt circuit 64 are connected by the conductive insert 40 of the switching member 29 whereby warning and/or inhibiting means and/or operating means of the seat belt circuit will be actuated in any of the drive positions. The terminals 38*a* will no longer be connected by the member 24 while the selector mechanism is in any of the drive positions, nor can they be reconnected by the member 26 since the spacing between the arms 34*b* is different from that between the terminals 38*a*.

The casing body 2 has a peripheral rim 67 that seats firmly in a recess 68 at the edge of the cover. Interruptions 69 of the rim coincide with the terminal positions so that in conjunction with the recess 68 there is formed at each such position a recess 70 surrounding the terminal at the outer face of the casing. The interior of the casing is sealed from the exterior by the body and cover being joined together by an adhesive seal and the sealing compound also fills the recess 70. On the collar there are inner and outer O-rings 72, 74, the outer ring forming a seal between the collar and the cover 4 and the inner ring forming a seal between the collar and the shaft.

The combined effect of the adhesive seal and the O-rings is that there is no opportunity for foreign matter to enter the casing from the exterior. There is no need to protect the path between the end flange 22 and the body 2 since this lies inwardly of the inner seal 72 towards the interior of the automatic selector mechanism into which the operating shaft projects.

WHAT WE CLAIM IS:—

1. A switch assembly arranged to be operated by a rotary shaft and comprising a plurality of fixed contact elements and at least one switching member rotatable with said shaft, said member comprising contact means arranged to engage the contact elements at least at one predetermined angular position of the shaft to connect said elements electrically, resilient means being arranged to provide contact pressure between the contact means of the member and the contact elements, and support means being provided for the switching member to hold the contact means in an air gap when out of engagement with the fixed contact elements, said contact elements being disposed at a level relative to said support means such that the contact means of the switching member are lifted from said support means by engagement with the fixed contact elements.

2. A switch assembly according to claim 1 wherein the contact means of the switching member comprises a plurality of contacts on respective resilient arms extending outwardly from the axis of said shaft, the or a part of the support means acting on said arms.

3. A switch assembly according to claim 1 or claim 2 wherein the contact elements are arranged at spaced intervals adjacent the radially outer region of the switching member and said support means comprise an arcuate track arranged to bear on a part of the switching member that is disposed radially inwardly of the contact means of the switching member.

4. A switch assembly according to any one of claims 1 to 3 wherein a coil spring at an inner annular region of the switching member acts as said resilient means, an inner support being provided for the member opposite the spring at an annular region radially outwards of said inner region but remote from the region of the contact elements.

5. A switch assembly according to any one of the preceding claims wherein a plurality of switching members are provided, each electrically insulated from the other, and respective groups of contact elements are arranged for co-operation with said switching members.

6. A switch assembly according to claim 5 wherein the contact elements associated with the switching members are disposed at a common radial distance from the rotary shaft axis.

7. A vehicle automatic gear selector mechanism having a switch assembly according to any one of the preceding claims and in which at least two contact elements are associated with a starting circuit of the vehicle engine and the rotary shaft is displaceable in conjunction with a selector lever of the mechanism, said switching member being arranged to permit operation of the starting

circuit in a plurality of positions of the selector lever by virtue of the member having alternative portions of its contact means arranged for connection with said at least two contact elements at different shaft positions.

8. A vehicle automatic gear selector mechanism according to claim 7 having at least two contact elements associated with a reversing light circuit of the vehicle, said switching member being arranged to connect said elements electrically when the rotary shaft is placed in the reverse gear selection position of the mechanism, thereby to permit operation of the reversing light.

9. A vehicle automatic gear selector mechanism according to claim 7 or claim 8 having supplementary contact means of an electrical circuit associated with passenger safety restraint means and arranged to render said circuit operative at chosen settings of said mechanism.

10. A switch assembly constructed and arranged for use and operation substantially as described herein with reference to the accompanying drawings.

11. A vehicle automatic gear selector mechanism having a switch assembly according to claim 10.

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1383752 COMPLETE SPECIFICATION
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Sheet 1

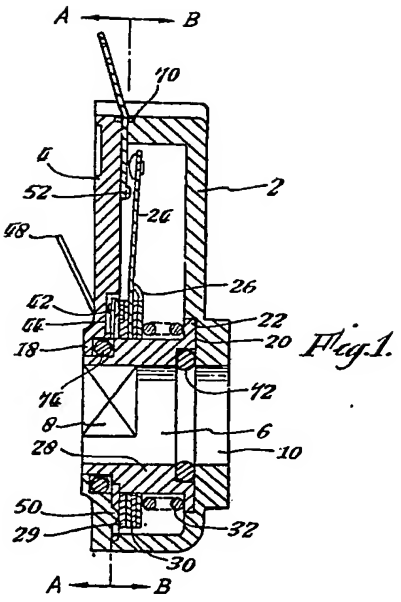

Fig. 1.

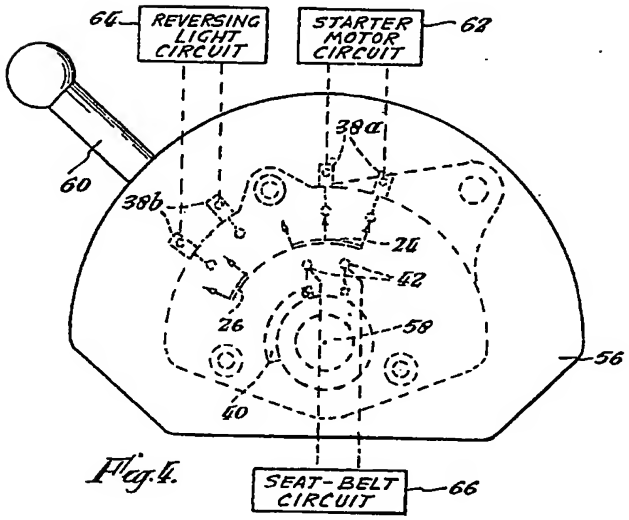

Fig. 4.

1383752 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

Fig. 2.

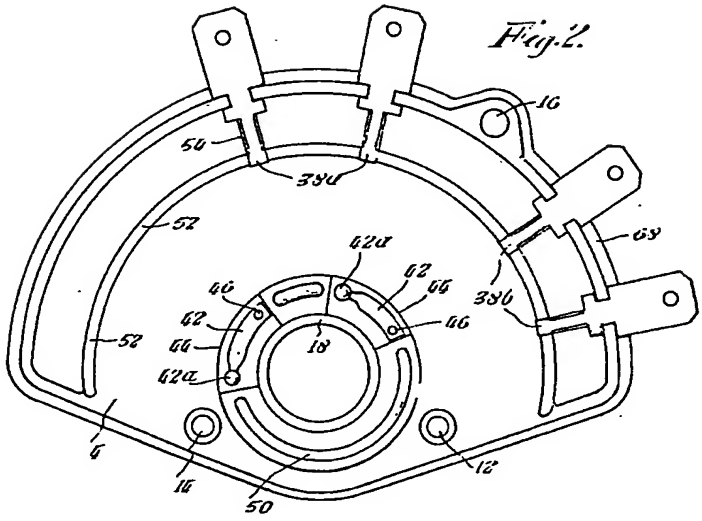

Fig. 3.